

ORIGINAL ARTICLE

Evaluating the Impact of a Preliminary Module-Based Intervention Programme to Increase Dengue Awareness among Kindergarten Children

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ABSTRACT

Introduction: Infectious diseases, mainly dengue, are known to infect young children. However, if properly educated, children will be able to stay alert and protect themselves against dengue. Thus, this study is conducted with the aim of introducing a newly developed, child-friendly, module-based programme through the analysis of knowledge and practice scores pre- and post- programme among children aged five to six years. **Methods:** The effectiveness of this module-based programme was tested among children from six KEMAS kindergartens from Kota Bharu who were specifically recruited for this pilot study. This programme consisted of a story telling session with three substories about dengue, that was carried out at each kindergarten visited. Data collection from the children was conducted using a validated questionnaire a week prior and a week after the programme. Results obtained were analysed using the Statistical Package of the Social Sciences (SPSS). Socio-demographic data was generated using the descriptive test while the comparison of scores before and after the module-based programme was tested using the Wilcoxon Sign-Rank test. All 72 children successfully contributed by answering questionnaires pre and post the programme. **Results:** Significant differences ($p < 0.001$) were observed in the knowledge and practice scores showcased by the children after completing the module-based programme. **Conclusion:** To conclude, this module-based programme can improve knowledge and practice levels of young children on dengue. This programme can be considered validated and is capable of initiating early dengue exposure especially on its knowledge and prevention among all kindergarten children.

Keywords: Dengue; Module-based programme; Children; Knowledge; Practice

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development of a competent and reliable vaccine, especially now due to the development of COVID-19 vaccines (5). In this case, community members play the biggest role to keep themselves away from dengue.

INTRODUCTION

Dengue cases have been affecting the health of our community, including children, for several decades now. Overall, a total of 785,736 cases had been reported worldwide while Malaysia alone has recorded 13,374 cases with the highest prevalence in the state of Selangor (1, 2). Over the decade, it was reported that a cumulative number of 450,000 children were infected between the age of zero to four years while almost half a million of them had been exposed to dengue infection by the age of 15 (3). Until today, there is still no record of having effective treatment for dengue. Health services are only capable of providing treatment to relieve the symptoms of dengue (4). There is also no confirmation on the

Many preventive practices had been introduced to prevent dengue in Malaysia; however, these practices and overall efforts only focus on adults. Children, who are also equally affected do not seem to be involved in any dengue education efforts in Malaysia. Studies on dengue that involve children are also very limited. Dengue health education and effort should be taken from young so that children will be able to identify vectors and practice prevention for increased awareness and protection in their surroundings, especially when not surrounded by parents or guardians. In many parts of America, young preschool – going children are already being involved as part of their dengue awareness programmes many years ahead of us (6). In fact, children can help influence adults by being ambassadors in promoting

dengue awareness. Studies on dengue health education in schools had been seen to reduce morbidity rates among students as the education had been successful in alerting students about dengue (7, 8).

The earlier the exposure towards dengue and dengue prevention practices, the better the development of awareness and preventive habits as adults. Hence, the objective of this study is to pilot test the efficacy of a module-based programme, specially developed for young children aged five to six years old. This programme was tested among kindergarten children from the Kemajuan Masyarakat (KEMAS) sector in Kelantan. This programme utilises the 'kamishibai' or Japanese story telling technique where the effectiveness of this module-based programme is measured through the evaluation of knowledge and practice scores obtained, by comparing them for any significant increase before and after the module-based programme. The implementation of this study can be used to disseminate dengue information through a module-based approach (story-telling technique) and establish a validated and systematic learning curriculum on dengue.

MATERIALS AND METHODS

Study design

In this study, the cross-sectional study design was used to test the effectiveness of a newly developed module-based programme among children aged five to six years old.

Recruitment of study participants

KEMAS kindergarten children were recruited from Kelantan using the convenience sampling method by involving only six kindergartens that were willing to participate during the Recovery Movement Control Order (RMCO) phase due to COVID-19 (9). From this method, a total of 72 children were selected from six kindergartens. Selected children fulfilled the inclusion criteria that requires them to be either five or six years old and voluntarily participate while children who were unhealthy, sick or with learning disorders were excluded. Ethical approval for this study was obtained from the Human Research Ethics Committee (JEPeM), Universiti Sains Malaysia (Reference number: USM/JEPeM/18070333).

Research instrument

This study was carried out using a validated dengue knowledge and practice questionnaire for children titled 'Borang Soal Selidik Pengetahuan dan Amalan terhadap Penyakit Demam Denggi untuk Kanak-Kanak' copyrighted (LY2022P03431) that recorded an internal consistency of 0.719 (10). This questionnaire had been previously validated using construct validity using the principal component analysis (PCA) in our previous paper (10). The questionnaire had four main sections

and 33 items in total. Items in the questionnaire were in Malay. The questionnaire consisted of knowledge subdomains such as 'general information on *Aedes* mosquitoes', 'stagnant water areas', 'life cycle of *Aedes* mosquitoes', 'peak time of *Aedes* mosquito bites' and 'symptoms of dengue fever' while the practice section consisted of only one domain which is the 'prevention of *Aedes* mosquito bites and breeding'. As for the scores, the same scoring method had been for both knowledge and practice domains where for knowledge, three options such as 'YES', 'NO' and 'DON'T KNOW' were provided, where the option 'YES' was given one mark while the options 'NO' and 'DON'T KNOW' were given zero mark (11). As for practice, three options such as 'NEVER', 'SOMETIMES' and 'ALWAYS' were provided, where the option 'ALWAYS' was given one mark while the options 'NEVER' and 'SOMETIMES' were given zero mark (11).

Pre- and Post-Questionnaire Distribution

Pre-questionnaire data collection was conducted one week prior to the module-based programme. This was done through a face-to-face interview approach by the researcher along with three other trained facilitators in the selected kindergartens. Parents and kindergarten authorities were briefed, and written permission was obtained from them before the period of data collection. A two metres distance was maintained, and face masks were worn throughout the visit for pre-questionnaire data collection. Selected children were then officially informed to join the module-based programme. All the children involved in the programme were then revisited after one week for post data collection after the programme.

Module-Based Intervention Programme

Selected children were visited on week after the pre-questionnaire data collection at their respective kindergartens to run the module-based intervention programme. The module-based intervention programme targets a passive learning method, where information were designed to be delivered in a Japanese story telling style, also known as the kamishibai. The kamishibai consists of a kamishibai stage and illustrative cards that depict the story line. Children were required to listen to the story and visualise through the illustrations developed. The kamishibai story cards consist of three different story parts combined, where they depict different parts of information on dengue as a complete story. Part 1 (copyrighted AR2022P03438) was written to introduce *Aedes* mosquitoes and breeding areas to children. Part 2 (copyrighted AR2022P03437) was written to introduce dengue, symptoms of dengue and steps that need to be taken if infected. Finally, part 3 (copyrighted AR2022P03441) was written to introduce potential breeding areas and preventive measures against *Aedes* mosquitoes and dengue infection.

Questions for reinforcement were included in the modules and asked at the end of each story part. Selected children, along with other children who were present on those particular days were included in this programme to avoid any kind of discrimination. However, data was only collected from participating children for study purposes. Face masks were constantly worn throughout the entire visit to the kindergartens. Children were briefed and story telling session started right after the briefing. Children were probed with questions to reinforce information and knowledge gained during the story telling session. The story telling session lasted for about 15 to 20 minutes in total. Both children and teachers were given gift bags as a token of appreciation to mark the end of the programme.

Data Analysis

Statistical analysis was conducted on the data collected using Statistical Package of the Social Sciences (SPSS) version 26 (12). The descriptive test was used to analyse socio-demographic data and the Wilcoxon Sign Rank Test was used to indicate any changes in the knowledge and practice scores after the programme. Significant results were observed at $p < 0.001$.

RESULTS

Socio-demographic characteristics

General socio-demographic information obtained from the children for the module-based intervention programme is summarised in Table I. Data from a total of 72 children were successfully recruited during the pre- and post-intervention programme (100% response rate). The age of children was observed to be almost equally balanced with 48.6% ($n = 35$) of children aged five years old while 51.4% ($n = 37$) of children aged six years old. The genders of children in this study were also almost equally divided with 47.2% ($n = 34$) male children and 52.8% ($n = 38$) female children. From the total of 72 children, 100% ($n = 72$) of them were of Malay ethnicity and Muslims. Most fathers recorded earnings of below RM1,000 (55.6%, $n = 40$) and half of them (50.0%, $n=36$) were self-employed. On the other hand, mothers were mostly unemployed (63.9%, $n = 46$) and many of them (81.9%, $n = 59$) have been recorded to earn below RM1,000.

Knowledge

Table II summarises the difference in correct knowledge of children on dengue after the module-based programme. Almost all children were able to answer the questionnaire correctly after exposure to the module-based programme of this study. All the children (100%) were able to identify dengue when asked after the module-based programme. Most of the children also correctly knew

Table I : Distribution of respondents' socio-demographic characteristics.

Variables	Number (N)	Percentage (%)
Age		
5 years old	35	48.6
6 years old	37	51.4
Gender		
Male	34	47.2
Female	38	52.8
Race		
Malay	72	100
Chinese	0	0
Indian	0	0
Religion		
Islam	72	100
Buddha	0	0
Hindu	0	0
Fathers' Profession		
Government sector	9	12.5
Private sector	24	33.3
Self-employed	36	50.0
Unemployed	3	4.2
Mothers' Profession		
Government sector	12	16.7
Private sector	4	5.6
Self-employed	10	13.9
Unemployed	46	63.9
Fathers' Income		
< RM 1,000	40	55.6
RM 1,000 – RM 3,000	28	38.9
RM 3,000 – RM 5,000	3	4.2
RM 5,000	1	1.4
Mothers' Income		
< RM 1,000	59	81.9
RM 1,000 – RM 3,000	10	13.9
RM 3,000 – RM 5,000	3	4.2
RM 5,000	0	0

about the transmission of dengue (88.9%), vector characteristics (94.4%) and breeding preferences of *Aedes* mosquitoes (95.8%) after the module-based programme. The children were no longer unaware of basic questions asked on *Aedes* mosquitoes after this programme as well, similar to the finding recorded after the activity – based programme. Before this module-based programme, most children failed to correctly identify stagnant water areas as potential breeding sites. However, after the programme, children

Table II : The percentage of correct answers for knowledge domain before and after the module-based programme.

No	Item	Pre intervention (n=46)			Post intervention (n=46)		
		Yes (%)	No (%)	Don't know (%)	Yes (%)	No (%)	Don't know (%)
Knowledge							
General information on <i>Aedes</i> mosquitoes							
P1	Dengue	69.4	25.0	5.6	100.0	-	-
P2	<i>Aedes</i> mosquitoes are the cause of dengue fever	65.3	20.8	13.9	95.8	4.2	-
P3	<i>Aedes</i> mosquitoes have black and white stripes on their body and legs	45.8	29.2	25.0	94.4	2.8	2.8
P4	<i>Aedes</i> mosquitoes breed in stagnant water	45.8	34.7	19.5	95.8	4.2	-
P5	Dengue fever can be transmitted to humans through the bite of female <i>Aedes</i> mosquito that has the virus	9.70	20.8	69.4	88.9	6.9	4.2
Stagnant water areas							
P6	Flower pot base	29.2	48.6	22.2	86.1	8.3	5.6
P7	Toilet pump tank	33.3	36.1	30.6	93.1	4.2	2.7
P8	Water tank	22.2	50.0	27.8	95.8	2.8	1.4
P9	Pail of water in the toilet	30.6	37.5	31.9	95.8	4.2	-
P10	Opened food and beverage containers	36.1	41.7	22.2	95.8	1.4	2.8
P11	Unused tyres	34.7	27.8	37.5	95.8	4.2	-
P12	Unclosed trash bins	33.3	41.7	25.0	88.9	6.9	4.2
P13	Clogged drains	30.6	38.9	30.5	83.3	8.3	8.3
Life cycle of <i>Aedes</i> mosquitoes							
P14	<i>Aedes</i> mosquito eggs hatch into larvae before they become adult <i>Aedes</i> mosquitoes	6.9	30.6	62.5	91.7	8.3	-
P15	<i>Aedes</i> mosquito larvae can only live in water	13.9	27.8	58.3	86.1	8.3	5.6
P16	The life cycle of <i>Aedes</i> mosquitoes from eggs to adult takes seven days	-	-	100.0	72.2	16.7	11.1
P17	<i>Aedes</i> mosquitoes bite the most in the early mornings	27.8	34.7	37.5	95.8	4.2	-
P18	<i>Aedes</i> mosquitoes bite the most in late evenings	52.8	13.9	33.3	94.4	5.6	-
Symptoms of dengue fever							
P19	Death causing if severe	69.4	25.0	5.6	100.0	-	-
P20	High fever	29.2	13.9	56.9	88.9	2.8	8.3
P21	Rashes	56.9	27.8	15.3	93.1	6.9	-
P22	Body and joint aches	26.4	44.4	29.2	90.3	9.7	-
P23	Vomiting	6.9	55.6	37.5	69.4	30.6	-

Table III : The percentage of the frequency of practice for practice domain before and after the module-based programme.

No	Item	Pre intervention (n=46)			Post intervention (n=46)		
		Always (%)	Sometimes (%)	Never (%)	Always (%)	Sometimes (%)	Never (%)
Practice							
Prevention from <i>Aedes</i> mosquito bites and breeding							
A24	Using mosquito net when sleeping	20.8	23.6	55.6	43.1	38.9	18.0
A25	Wearing covered clothes when going out	37.5	48.6	13.9	75.0	16.7	8.3
A26	Using mosquito sprays	36.1	52.8	11.1	88.9	6.9	4.2
A27	Using mosquito repellent before leaving the house	16.7	15.3	68.0	44.4	41.7	13.9
A28	Using electrical mosquito coil	22.2	62.5	15.3	43.1	44.4	12.5
A29	Removing water from containers that hold water	13.9	56.9	29.2	59.7	29.2	11.1
A30	Closing trash bins after disposing rubbish	55.6	33.3	11.1	95.8	4.2	-
A31	Changing water in flowerpots	6.9	23.6	69.4	29.2	29.1	41.7
A32	Washing the base of flowerpots	9.7	25.0	65.3	30.6	29.1	40.3
A33	Throwing food and beverage containers into trash can	80.6	16.6	2.8	100	-	-

were able to correctly identify stagnant water areas such as the water tank, pail of water in the toilet, unopened food and beverage containers and unused tyres (95.8%) recorded similar and the highest percentage of correct answers.

The children, however, severely lacked knowledge on the life cycle of *Aedes* mosquitoes. Most children gave correct answers when asked about the larval stage of *Aedes* mosquitoes (91.7%) and the duration of a complete life cycle (72.2%), after the module-based programme. When compared to the outcome after the activity – based programme, children exposed to the module-based programme were able to give satisfactory level of correct answers when asked regarding the peak time of *Aedes* mosquito bites. Most children correctly knew that *Aedes* mosquitoes bite in the early mornings (95.8%) and late evenings (94.4%). Moving on to dengue symptoms, all children (100%) correctly identified high fever as one of the important symptoms of dengue after the module-based programme. Most children were also seen to be aware of other symptoms related to dengue such as rashes (88.9%), body and joint aches (93.1%) and vomiting (90.3%) by giving correct answers after the module-based programme.

Practice

Table III summarises the difference in the frequency of practices among children to prevent dengue after the module-based programme. After this module-based programme, all children were seen to correctly and frequently practice throwing away food and beverage containers into trash cans (100%). When asked about practices such as the usage of mosquito sprays (88.9%) and closing the trash bins after disposing rubbish (95.8), children indicated a correct and frequent practice levels after the programme. However, practices such as changing water in flowerpots (29.2%) and washing the base of flowerpots (30.6%) were not correctly responded to even after the module-based programme.

Knowledge and practice scores before and after module-based programme

As for knowledge, a significant increase of the overall scores after the programme is evident with a median score of 21.0 (IQR 2.0) which is higher, than the median score of 8.0 (IQR 4.0) that was recorded before the programme, $p < 0.001$ (Table IV). Every sub-domain under the knowledge domain also collectively displayed a significant increase of scores with higher median scores post-intervention

Table IV : Comparison of knowledge and practice scores before and after the module-based programme

Variable	Median (IQR)		Z statistics	p – value
	Pre-	Post-		
Knowledge				
Sub-domain 1 : General information on <i>Aedes</i> mosquitoes	3.00 (2.00)	5.00 (0)	-7.448	0.001**
Sub-domain II : Stagnant water areas	1.00 (0)	2.00 (0)	-8.105	0.001**
Sub-domain III : Life cycle of <i>Aedes</i> mosquitoes	0 (0)	3.00 (1.00)	-7.512	0.001**
Sub-domain IV : Peak time of <i>Aedes</i> mosquito bites	3.00 (3.00)	8.00 (1.00)	-7.397	0.001**
Sub-domain V : Symptoms of dengue fever	2.00 (2.00)	5.00 (1.00)	-7.441	0.001**
Total score for knowledge	8.00 (4.00)	21.00 (2.00)	-7.389	0.001**
Practice				
Prevention from <i>Aedes</i> mosquito bites and breeding	3.00 (2.00)	6.00 (2.00)	-7.459	0.001**

Wilcoxon Paired Sign-Rank test

**Marginally significant at $p < 0.001$

programme compared to initially recorded scores. A significant increase is also seen in the overall scores for the practice domain after the programme. This is evident as the median score after the programme 6.0 (IQR 2.0) is marginally higher than the median score of 3.0 (IQR 2.0) before the programme, where $p < 0.001$.

DISCUSSION

This study indicates that participating children were able to answer almost all items correctly for all five sub-domains as a good increase in the percentage of correct answers after the module-based programme is observed. The most successful transfer of information was seen in the knowledge domain where almost all children knew that dengue can only be propagated to from one human to another via female *Aedes* mosquitoes. This similar finding was also observed in two different studies that tested the effects of health education interventions involving public and private school students in Jeddah as well as teenage school children in India, respectively (13, 14). This also indicates that health education through the kamishibai approach can be useful for children (15).

Before the programme, children were observed to be confused in identifying stagnant water areas as breeding sites. However, after the programme, children were able to identify areas that can hold clean or dirty stagnant water and recognise them as potential breeding sites for *Aedes* mosquitoes (16). Children were seen to understand that *Aedes* mosquitoes can breed in areas they were familiar with in the story,

hence, easily understood. Overall, a good increase in terms of breeding places of *Aedes* mosquitoes was reported to be similar in a different study in India as well (14).

An impressive increase in the percentage of correct answers on the life cycle of *Aedes* mosquitoes was recorded after the programme. This increase was reported in a different study that aimed to evaluate dengue education in primary schools in Brazil as well (17). In this case, all children were initially completely unaware about the duration taken for the eggs to be developed into adult *Aedes* mosquitoes. This is because children were not adequately exposed to the life cycle of *Aedes* mosquitoes as they were perceived to be difficult information. Apart from that, most of the children learned that *Aedes* mosquitoes bite during sunrise after the programme, which they initially did not know about opposite to a finding observed in a health education study to test on knowledge, attitude and practice (KAP) levels among the urban poor community members in Delhi (18). It is important for children to know peak biting times as it can indirectly act as a prevention measure to avoid getting bitten.

The symptoms of dengue fever exhibited a massive escalation in the percentage of correct answers after the programme for all its items. All children were seen to successfully indicate fever as one of the dengue symptoms apart from other febrile illnesses after the programme. A similar finding was also reported in several other studies among high school students in Jeddah and Malaysia respectively (13, 19, 20).

However, the increase in the percentage of correct answers for all other symptoms suggests that children are more open to identifying correct symptoms related to dengue after the programme. Children should be aware of dengue symptoms for earlier detection and treatment as these symptoms are usually overlooked by most people (20).

The practice domain marked a good increase in the percentage of correct answers for all items after the programme. Similar finding was reported in a different study after the introduction of specific health programmes in a school located in Sri Lanka (21). All children adhered to throwing food and beverage containers into the trash can while most of them followed the practice of closing the trash bins after the programme. Both these practices were probably the easiest practices that can be done by young children. However, changing water in flowerpots and washing the base of flowerpots were observed to be the practices with the least percentage of frequency among children even after the programme. This is probably because both these practices were difficult for children to practice on their own. In fact, the prevalence of both these practices among adults was relatively low as well (22). Some children informed that they did not have flowerpots that need water to change or to be washed at home. Self-protection practices doubled after exposure through this programme. The same finding on the same line of dengue prevention practices was again identified in two other different studies among school children from Jeddah and India, respectively (13, 14). Most children reported that parents included these practices in their daily routine, as these practices were easily grasped by parents as they were more familiar methods of preventing mosquito bites.

The practice of removing stagnant water areas also increased well after the programme. Similar findings were also reported previously (14). Standing water is usually collected in many different areas in a household. Hence, adhering to this practice will enable parents and their children to discard standing water from any potential container and act as catalysts to change their parents into following correct practices that can prevent dengue. This was also supported by a study that focused on school students as change agents against dengue (23). The act of educating of children with adequate knowledge and preventive practices of a disease promotes the dissemination of information to their families, leading to the stimulation of source reduction in households which is important in controlling the spread of the disease (24).

Scores recorded for the knowledge domain after the module-based programme showed a significant increase among children, justifying that this specially

designed programme using the kamishibai approach is effective in delivering knowledge on *Aedes* mosquitoes and dengue in this study. Similar outcomes were also recorded in several other studies that used the kamishibai based approach to improve or teach in the desired areas of education (25, 26). Apart from that, the kamishibai is formatted to cater a large group of young audience using simple language, dialogues and intonation that relates to the imagination of the audience that elevates the effectiveness of this method (27, 26). Hence, this is a suitable method to be used in kindergartens, where it is designed and developed for young children in their learning and developing stages.

The question-and-answer sessions after each part of the story in this storytelling method can be classified as one of the best ways in teaching young children as every important key fact in the story can be repeated to children for several times, improving their grasping power (28). A study had proved that repetition of dengue information helps improve understanding among children (29). Hence, this method is seen best in terms of reinforcement. This is the first study that utilises kamishibai to engage health-based education among children in Malaysia, where in contrast, the kamishibai had already been utilised in health education in Japan and is evolving in India, for education on reproductive health (30). Based on the significant differences of knowledge scores before and after the programme, this method of intervention can be considered successful in delivering important information on dengue and had targeted the right areas of important dengue information to fill the lack of knowledge among children.

As for practice, there is a significant increase in the total scores recorded after the programme. Similar findings on the difference of practice scores among school children had been recorded using educational health interventions as well (16, 19). However, the increase in practice scores is found to be lesser compared to total knowledge scores after the programme. This is because knowledge is easily absorbed as general information and can be answered correctly when required. This is different as compared to practice scores as practice needs time and effort to become habitual over time (31). Apart of that, these children are young children with minimum or least amount of exposure to preventive practices on dengue, hence, their learning would be new and a little difficult to be applied at home as some of the practices need to be done under parental guidance.

Despite showing a lower increase than knowledge scores, this module-based programme played an important role in introducing and elevating practice

levels among young children. Each time after the programme, children were reminded and encouraged to share and help parents with the prevention measures learned through the programme. We learned that this information might have influenced the children to ensure these practices are done at home. This is because, when the practices are learned in school, they would be considered reliable by children and especially parents (32).

As for the limitation, the outcome obtained from this programme is only based on a short, one time measurement of knowledge and practice scores. Thus, it difficult to check the if all information learned lasts for a longer period. More follow-up measurements and reinforcement can be done for a more enhanced grasp of the knowledge and practices. This module-based programme can also be further validated by sampling a larger number of kindergarten children. Changes in scores can also be descriptively analysed to understand the prevalence of children with good, moderate or low knowledge and practice scores before and after the intervention programme. Nevertheless, the objective of this research has been proven successful on a pilot level, strengthening the belief that this programme is competent in enlightening and cultivating important and correct prevention to curb dengue among young children. This study is novel as the intervention programme targets a much younger group, which is uncommon here in Malaysia and can be considered the strength of this study. Overall, this module-based programme is an approach that is worthwhile in disseminating and elevating existing dengue information in children, showing that children can be game changers and efforts taken for habitual changes can start young.

CONCLUSION

This newly developed module-based programme is observed to be significant in improving dengue knowledge and practice levels among kindergarten children. This programme will be able to influence other initiatives that involve young children in dengue prevention programmes. Considering the effectiveness of the programme, formal education can be enhanced to include dengue prevention in kindergartens and create a generation of adults who are well aware and protected from dengue.

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